

ABSTRACT OF THE DISCLOSURE

Methods of preparing improved semiconductor substrates having gate oxide layers formed thereon, and use of such substrates in fabricating improved semiconductor devices, are disclosed. The methods include a first step of performing a cleaning process for removing a natural oxide layer formed on a semiconductor substrate and also for removing an oxide layer generated by the removal of the natural oxide layer; a second step of executing a hydrogen annealing process to form a hydrogen passivation layer and for further reducing a surface roughness of the semiconductor substrate completed in the cleaning process; a third step of forming a gate oxide layer thereon; a fourth step of performing a nitridation process on the gate oxide layer to prevent the semiconductor substrate from a permeation of ions during a subsequent gate electrode formation step; and, a fifth step of performing a subsequent thermal process to stabilize a surface of the gate oxide layer, thereby improving a defect rate of the device caused in forming the gate oxide layer.

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